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Pacific Region

Proceedings of the regional peer review of the updated assessment of Bocaccio Rockfish in British Columbia

May 29, 2012

Nanaimo, BC

Andrew Edwards Chairperson

Andrew Edwards Editor

Fisheries and Oceans Canada
3190 Hammond Bay Road
Nanaimo, BC V9T 6N7

October 2013

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

These Proceedings summarize the relevant discussions and key conclusions that resulted from the Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) Regional Peer Review meeting of May 29, 2012, at the Pacific Biological Station in Nanaimo, B.C. One working paper was presented for peer review, focusing on an updated stock assessment of Bocaccio for British Columbia waters.

In-person and web-based participation included Fisheries and Oceans Canada staff from the Science Sector and the Fisheries and Aquatic Management Sector, plus external participants from the commercial and recreational fishing sectors, academia, provincial government and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

In 2011, the Governor in Council decided not to add Bocaccio to the List of Wildlife Species at Risk. One of the steps taken to provide protection to the Bocaccio population was to be an updated DFO assessment of Bocaccio scheduled for review in 2011 or 2012, that would not only update previous work with four more years of data, but coincide with a COSEWIC re-assessment scheduled for 2012. The working paper presented at this review meeting is the updated assessment. During the review meeting, an extra sensitivity model run was deemed necessary – if the results were markedly different from the original reference case then the working paper would require substantial revision and be reviewed at a new meeting. However, the sensitivity run was completed before the end of the meeting, and the results were similar to the reference case. Thus an extra review meeting was not required, and the presented working paper was accepted subject to other revisions.

The conclusions and advice resulting from this review will be provided in the form of a Science Advisory Report giving advice to update the previous assessment and coinciding with a re-assessment by COSEWIC, scheduled for 2012.

The Science Advisory Report and supporting Research Document will be made publicly available on the DFO Science Advisory Schedule.

Compte rendu de la réunion régionale d'examen par les pairs de l'évaluation mise à jour du bocaccio en Colombie-Britannique.

SOMMAIRE

Le présent compte rendu résume les discussions importantes et les principales conclusions de la réunion régionale d'examen par les pairs du Secrétariat canadien de consultation scientifique (SCCS) de Pêches et Océans Canada qui s'est tenue le 29 mai 2012 à la Station biologique du Pacifique de Nanaimo, en Colombie-Britannique. Un document de travail a été présenté aux fins d'examen par les pairs. Ce document portait sur une évaluation mise à jour des stocks de bocaccio dans les eaux de la Colombie-Britannique.

Au nombre des participants qui ont assisté à la réunion en personne ou par conférence Web, on comptait des représentants des secteurs des Sciences et de la Gestion des pêches et de l'aquaculture de Pêches et Océans Canada ainsi que des secteurs de la pêche commerciale et récréative, des universités, du gouvernement de la province et du Comité sur la situation des espèces en péril au Canada (COSEPAC).

En 2011, le gouverneur en conseil a décidé de ne pas ajouter le bocaccio à la liste des espèces sauvages en péril. Parmi les mesures prises pour assurer la protection de la population de bocaccio, le MPO devait réaliser une évaluation mise à jour du bocaccio que l'on prévoyait examiner en 2011 ou 2012. Cette évaluation mise à jour servirait à actualiser l'évaluation précédente grâce aux données recueillies pendant quatre années supplémentaires et coïnciderait avec une réévaluation du COSEPAC prévue pour 2012. Le document de travail présenté lors de cette réunion d'examen est l'évaluation mise à jour. Lors de la réunion d'examen, on a estimé qu'une exécution supplémentaire du modèle aux fins d'analyse de la sensibilité était nécessaire – si les résultats obtenus étaient nettement différents de ceux du scénario de référence, le document de travail devrait alors faire l'objet d'une révision approfondie et d'un examen lors d'une nouvelle réunion. Toutefois, l'exécution supplémentaire du modèle a eu lieu avant la fin de la réunion puisque les résultats étaient semblables à ceux du scénario de référence. Par conséquent, une nouvelle réunion d'examen n'était pas nécessaire et le document de travail présenté a été adopté sous réserve d'autres modifications.

Les conclusions et avis découlant de cet examen seront présentés sous la forme d'un avis scientifique, lequel conseillera de mettre à jour l'évaluation précédente et coïncidera avec la réévaluation par le COSEPAC, prévue pour 2012.

L'avis scientifique et le document de recherche à l'appui seront rendus publics dans le calendrier des avis scientifiques du MPO.

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Peer Review meeting was held on May 29, 2012 at the Pacific Biological Station in Nanaimo, BC, to review an updated stock assessment of Bocaccio Rockfish in British Columbia waters.

The Terms of Reference (TOR) for the science review (Appendix C) were developed in response to the scheduled updated assessment of Bocaccio that formed part of the Governor in Council decision not to add Bocaccio to the List of Wildlife Species at Risk. Notifications of the science review and conditions for participation were sent to external representatives with relevant expertise from First Nations, commercial and recreational fishing sectors, environmental non-governmental organizations, provincial government and academia.

The following working paper (WP) was prepared and made available to meeting participants prior to the meeting (Abstract provided in Appendix D):
Updated stock assessment for Bocaccio (*Sebastes paucispinis*) in British Columbia waters for 2012, by Richard D. Stanley, Murdoch McAllister, and Paul J. Starr. (CSAP WP2012/P42).

The meeting Chair, Andrew Edwards, welcomed participants and invited them to each introduce themselves, including the five participating by Webinar. He reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. He discussed the role of participants, the purpose of the various resulting meeting publications (Science Advisory Report, Proceedings and Research Document), and the definition and process around achieving consensus decisions and advice. Everyone was invited to participate fully in the discussion and to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions and advice. It was confirmed with participants that all had received copies of the Terms of Reference, Agenda and the working paper.

The Chair reviewed the meeting's Agenda (Appendix A) – noting an amendment that the second written review would not occur – and Terms of Reference (Appendix C). He then reviewed the ground rules and process for exchange, reminding participants that the meeting was a science review and not a consultation. The room was equipped with microphones to allow remote participation by web-based attendees, and in-person attendees were reminded to address comments and questions so they could be heard by those online.

Members were reminded that everyone at the meeting had equal standing as participants and that they were expected to contribute to the review process if they had information or questions relevant to the paper being discussed. In total, 21 people participated (listed in Appendix B). Kate Rutherford was identified as the Rapporteur.

Participants were informed that Doug Swain (DFO Gulf Fisheries Centre, Moncton, New Brunswick) had been asked before the meeting to provide a detailed written review of the working paper to assist everyone attending. Participants were provided with copies of the written review.

The conclusions and advice resulting from this review will be provided in the form of a Science Advisory Reports, which together with the resulting Research Document (the revised Working Paper) will be made publicly available on the DFO Science Advisory Schedule.

REVIEW

Working Paper: Updated stock assessment for Bocaccio (*Sebastes paucispinis*) in British Columbia waters for 2012, by Richard D. Stanley, Murdoch McAllister, and Paul J. Starr. (CSAP WP2012/P42)
Rapporteur: Kate Rutherford
Presenter(s): Richard Stanley

PRESENTATION OF WORKING PAPER

The lead author gave a presentation of the Working Paper, the Abstract for which appears in Appendix D. He noted that the methodology and inputs were described in the earlier 2009 Research Document (Stanley et al. 2009) and that this is an update. He gave the context of the assessment with respect to the earlier COSEWIC designation and decision in 2011 not to list Bocaccio under the Species at Risk Act – full details are in the Terms of Reference in Appendix C. The motivation for the current assessment (there was no Request for Science Information and Advice) was that an updated assessment was scheduled for review in 2011 or 2012 (as one of the steps to provide protection of the species), that would not only update previous work with four more years of data, but coincide with a COSEWIC re-assessment scheduled for 2012.

The main results from the Stanley et al. (2009) assessment, that were updated in DFO (2009), were that the biomass of the stock was estimated to have shown a progressive decline since the 1930s, and the estimated median ratio of the 2008 biomass to that at maximum sustainable yield, B_{2008}/B_{MSY}, was 0.11, with a replacement yield of 198 t.

The current assessment updated the previous one with new data, for 2008-2011, and added some enhancements to the previous work. The approach remained to use a Bayesian surplus production model, using life history information to obtain a prior on the parameter *r*, together with catch history data and time series of relative abundance indices. The reviewer pointed out that there are far fewer females than males represented in the ageing data.

The lead author said that the 50% female age-at-maturity value was reduced from 8.5 y (in the previous assessment) to 7.1 y with the addition of new data. The generation time is about 20 y.

The lead author summarized the catch sources – noting that new to this assessment was the use of recreational data – and described aspects of the catch reconstruction. It was clarified that historic data came from a recalculation (back calculated), whereas recent data are from monitoring.

It was asked whether the 1985-1996 catch data come from logbooks, the reply being that they were a combination of sales slips, logbooks and port samplers' observations. It was also asked, since the 1985-1996 period coincided with trip limits, which Bocaccio did not have, could there be a misidentification issue? An author agreed, noting that the catch data shows a big increase, and that the model has a sensitivity run with the catch halved from what was "recorded", showing little impact by halving. Another author said that he could try different scenarios for sensitivity runs, and welcomed provision of further information.

It was clarified that the catch used for 2012 was assumed equal to 2011 for all sectors. The creel surveys were used to generate recent estimates of recreational catch. Bocaccio were identified in the creel surveys, although some catches simply indicate "rockfish". Identification was not as good in the north coast area. There was a minimum of 1 t (about 240 fish) of recreational catch for the coast – some rockfish were not

identified to species so the true number was likely higher. The large increases in Bocaccio in recent years were due to improved rockfish identification in creel and lodge surveys.

A participant didn't believe that recreational catches were ever as high as 30 t, as calculated from about 1960-1985. The authors responded that the estimate resulted from back-calculating based on recent catch rates adjusted by greater fishing effort and higher abundance of Bocaccio in the past.

It was asked whether the authors were confident with the species identification in the recreational fishery, and one replied that he was not, which is why there is the range of 1-10 t. The questioner thought the estimates could be higher, which the author noted emphasizes the need for collection of better data but did note that recreational monitoring was improving.

An industry participant noted that the practice in the past was to misidentify trawl catch if there was a big catch of something that did not have a trip limit. The author noted that there were some large changes from fishers' logbooks based on port sampler observations – e.g., changing from Widow Rockfish to Yellowtail or Silvergray to Bocaccio. There continued a discussion, with one participant wondering about other minor species such as Redstripe, and another thinking that they would show large catches from 1986-95. Also, a year or two either side of the introduction of Individual Transferable Quotas might provide guidance. An author pointed out that there were still large catches before 1986, though a participant doubted those early numbers.

Further discussions concerned checking the percentage of total rockfish catch that was Bocaccio to see if it remained fairly constant over time, and that if it didn't remain fairly constant an author suggested this might require redoing the model runs. A participant asked about discards, but these might have to be anecdotal (e.g. some might have occurred in the middle of the night). An industry participant gave an overview of the fishing period in the 1990s, regarding trip limits and quarterly quotas that may have affected fishing behaviour.

Due to concerns that catch values in 1985-95 may have been overestimated (since there were no trip limits on Bocaccio at that time), it was agreed that the authors should run the following extra sensitivity test:

1. Reduce catches from 1986-95 to 25% and 50% of original values, and re-run the model.
2. If the median depletion (current biomass as a percentage of unfished biomass) is now >10% for either stock (denoting a higher stock status than the originally reported), then consider changing the methodology as follows:
    - examine the catch ratio of Bocaccio to total rockfish from 1996-2004.
    - apply the ratio to the total rockfish recorded caught in the 1986-95 period, corrected for:
        a) dumping, discarding and unreported landings and
        b) the combined effect of observers on board and change to Individual Vessel Quota system.
    - Consider using this as a new reference case.

A participant wasn't comfortable with choosing a new reference case without it being reviewed. An author emphasized that it would be a new reference case only if there were substantive changes in the results and perception of the status. Another participant

agreed that a new reference case could not be agreed upon now, because there would still need to be some estimated parameters used for the reconstruction. Thus, an author agreed that, if necessary, we would need a follow-up review meeting.

Note that just before the end of the meeting an author had managed to re-run the model (number 1. above, with catches from 1986-95 set to 25% of the original values), and it made little difference. The results would be included in the Research Document. Given these results, a follow-up review meeting would not be required.

An author continued the presentation, showing abundance trends from surveys and trawl commercial catch-per-unit-effort data from 1996-2004. He noted that the model had changed slightly from the previous assessment. Among other minor changes, the estimate of the parameter r was modestly changed.

The results of the current reference case showed basically the same long-term picture as seen in the 2009 assessment, but gave a stronger indication of declines over the last decade despite declines in catches. The drivers are the declines in the West Coast Vancouver Island and Queen Charlotte Sound surveys. It was noted that Figure 17 does not show all the survey points in all the panels due to scaling of the y-axes.

Table 12 showed the reference case status compared to the medians from the 2009 assessment – the population continues to lie well within the critical zone. The estimate of replacement yield was down from 198 t in 2009 to 143 t. The critical number is the catch/replacement yield, which should be <1; the median is 0.9898.

It was asked why the status was worse than 2009. It was mostly because the recent surveys were down in spite of lower recent catches, which made the survey catchabilities higher and more precise.

All sensitivity runs show the population to be well below $0.4B_{MSY}$; they provided little basis for disputing the conclusions of the reference case. The table of Bayes factors did not provide results to support or reject the use of the reference case.

The reference case decision table showed that 125 t per year is the cusp for the 20-year projection biomass to exceed the current biomass with probability >0.5.

The US assessment for California (the traditional centre of the fishery), showed 26% depletion with some signs of rebuilding.

The 2009 research recommendations were reviewed to say what was and wasn't done, and an overview of the 2012 recommendations was given. The authors recommended another assessment no later than 2022. While an earlier assessment would be preferred, it should be recognized that many other species require assessment. However, in the interim period, survey results could be checked.

A participant clarified if the zeros in Table 19 were medians, and could this show the point of extinction. An author replied that there are more decimal places, but if the population got to the point of less than one animal in the model then it was considered extinct.

WRITTEN REVIEW

A summary of the major issues identified in the meeting by the reviewer is included below, and the full review appears in Appendix E.

Doug Swain

The reviewer noted the tremendous amount of work done by the authors (including in the earlier assessment). He only had a couple of days available to conduct his review, and so had not been able to be as thorough as he might have wished, but noted that the foundations for the assessment have already been thoroughly reviewed in the earlier assessment meeting and in the peer-reviewed literature.

Given the limitations of the data, he agreed with the Bayesian surplus production model approach. He found that a comprehensive and innovative approach was used to fill gaps in the data, which were well supported by analyses. Uncertainly was well reflected, though he recommended, in the resulting Science Advisory Report, the listing of additional uncertainties that could not be accounted for in the modelling. These are given in detail in Appendix E.

The Authors responded to the reviewer's questions, in particular:

- clarifying the iterative reweighting procedure used for observation error;
- explaining that the 2012 assessment is less optimistic than 2009 because the stock is deemed to be less productive than in 2009;
- explaining that the authors hadn't looked at potential drivers of important changes in productivity (such as regime shifts);
- explaining that a truncated normal distribution was used for the index data in order to accommodate zeros.

In conclusion, the reviewer congratulated the authors again on their work and found the assessment conclusions to be well supported by the analyses and uncertainty to be well reflected in the advice. Despite some additional uncertainties and potential biases, he noted that it is clear that there is a very high probability that the stock is severely depleted and in the critical zone.

GENERAL DISCUSSION

A participant asked why pinniped predation was not included. An author replied that an assumption of predation on the outside stocks could currently not be defended. Another participant asked whether planning for future assessments should be based on life history. An author replied that from a Bocaccio viewpoint one should assess more frequently than every 10 years (say every two years), but that would mean ignoring other species. It was noted that a single strong recruitment event might not be enough to change the status of the stock.

There were several requests for extra details regarding results. These included:

- Table 11 – add statistics concerning the ratio B_{2011}/B_{2001};
- show the numbers (in a table) for the declines shown in Figure 17.

A participant stated some figures are needed to go with Table 19, for example, to better illustrate the uncertainty. For example, the 60-year projections are quite meaningless because of the large spread of the resulting distribution – at 60 years with the 125 t catch policy, the probability of being $<0.11B_{MSY}$ is 0.5 (from the median calculation), yet

the probability of being >0.8B_{MSY} is 0.44. Thus the distribution is very broad and so not very informative. This would be clear in a figure that included uncertainties. It was also requested that decision tables similar to those produced for Yellowmouth Rockfish (DFO 2012), be included to show the number of years to reach targets (with 50%, 80% and 95% probabilities).

Regarding the recreational fishery, it was confirmed that catchability was fixed at one point in time and then catch was calculated backwards using the total effort (from creel surveys, independent of what is caught). It was asked whether the effort was based on area or averaged across the whole coast. The authors responded that the same effort database was used as in the Quillback assessment. There was no attempt to provide area-specific effort series. Results were averaged in the recreational catch estimates; there were too few data to attempt more complex backwards imputations. Furthermore, changes to the imputation of historical recreational effort would have little or no impact on the assessment. However, the authors said that they would improve the documentation of the methodology and further emphasize the uncertainty.

A participant asked about the comment in the paper regarding the recreational effort going down. There was actually increased effort off the west coast of Vancouver Island, with a change in the fishery due to more targeting on halibut and rockfish, and boats going further offshore.

It was clarified that the results of this assessment will be included in the forthcoming COSEWIC report. A participant requested an evaluation of the trend in biomass over the past 10 years, as an estimate of the probability of decline and the median and confidence intervals of the ratio of B_{2011}/B_{2001}. The authors agreed that this was possible and would include it in the revisions.

It was noted that Figure 15 should not be used for this species, as the original table is for semelparous species (species that spawn only once), not iteroparous (like Bocaccio).

Regarding the recommendation to work on a reassessment in 10 years, a participant requested addition of the words "or sooner based on new information (e.g., surveys)", to which an author agreed (and noted that there was already wording to say data will be looked at in five years).

It was asked how the process error deviates were moved from 0.7 to 0.67? Regarding Figure 19, on historic estimates of process error, an author explained that it shows long runs of negative deviates and he worked out the correlation. There were now more years of data, and going from 0.67 to 0.7 will make the deviates more correlated in the future.

There was further discussion on the catch sensitivity run given above, including a request for clarification on the correction factors. An industry representative said that you used to be able to catch whatever you wanted and also discard what you wanted. With the advent of observers in the trawl fishery, fishermen would avoid low Individual Transferable Quota species but could keep all the Bocaccio they wanted.

Further discussion was based on the aforementioned catch sensitivity run, and it was re-iterated that if a new reference case was warranted then there would need to be a new review meeting, which would put the COSEWIC process behind by a year. One aspect of the sensitivity run would require an author sitting down with some skippers to estimate parameter values. Someone asked if this issue had come up in the previous 2009 assessment.

A COSEWIC representative asked when COSEWIC could use the information in the tables. An author agreed to send some results if participants had no objections (providing a new reference case was not needed). There were no objections.

The Chair asked if the working paper had met the following objectives of the TOR (with responses in italics):

- update the previous assessment with four more years of data – *yes;*
- provide, with rationale, a Limit Reference Point, an Upper Stock Reference, a Target Reference Point and a Removal Reference, guided by the DFO Sustainable Fisheries Framework – *yes, though no target reference point was suggested;*
- assess the status of the stock relative to the recommended reference points – *yes, showing the stock is well into the critical zone;*
- predict the consequences of varying harvest levels on future population trends – *yes, given by the decision tables.*

The Chair asked for a decision on the acceptability of working paper – subject to the aforementioned caveats and results of the sensitivity run. The participants agreed to accept the working paper.

The conclusions were summarised (and are given below).

Returning to the catch question, a participant noted that there seemed to be a lot of Bocaccio in 1935, about 45,000 t, and wondered how this compared to other rockfish species back then. An industry representative thought that some numbers were extremely exaggerated. He didn't see Bocaccio in big numbers in the mid-1960s. His father fished in the 1950s (Bocaccio were called sea bass then) and large amounts were not seen. He also asked that if Bocaccio was listed as endangered, what would it need to be rebuilt to? An author pointed out that the DFO Precautionary Approach is concerned with getting the stock above the reference point of $0.4B_{MSY}$, whereas the world of COSEWIC is focused on the minimizing the chance of extinction.

There was a discussion on the recommendations from 2009, and that catches had since been lowered but the biomass is still falling. The authors pointed out that they never stated anything was a 'safe' trajectory, they just gave the options, and that some things may be beyond human control, e.g., consumption by seals and sea lions, so even with zero catch some stocks may still go down.

The Chair asked about including Ecosystem Considerations in the SAR. Participants responded that there had been no discussion on this area (nor inclusion in the Working Paper) and did not want to start inventing wording, and so this section would be omitted from the SAR. The advice for management would take the form of the decision tables.

Near the end of the meeting, an author announced that he had completed the aforementioned sensitivity test regarding catch numbers. He reduced the catches for 1986-95 to 25% and it made no difference to the results, with the median at 3.3 %. Thus, the original reference case results stand, this extra run would be an additional sensitivity run, and there would not need to be a further review meeting.

The meeting was adjourned 4:12pm.

CONCLUSIONS

- Based on the reference case, the median estimate of B_{2012}/K (the ratio of current stock size to the unfished stock size) is 3.5%, with 90% confidence limits of 1.4-9.1%. The median estimate of B_{2012}/B_{msy} (the ratio of current stock size to that at maximum sustainable yield) is 7.0%, with 90% confidence limits of 2.9-18.2%.

- The stock is estimated to have a probability of 99% of being in the provisional DFO precautionary approach critical zone (whereby $B_{2012} < 0.4B_{msy}$).
- Sensitivity runs demonstrated considerable uncertainty, but were consistent in indicating that the stock is in the critical zone.
- Most of the surveys indicate decreases in relative biomass since 2008, despite total catches being among the lowest in the history of the fishery.
- Current harvest are approximately equal to the median estimate of replacement yield.
- Projections are given over 5, 20 and 60 years under varying assumptions of fixed catches.
- The working paper was accepted subject to revision.
- The objectives of the TOR were achieved.

RECOMMENDATIONS & ADVICE

The advice is in the form of decision tables, with managers reminded about the great uncertainty in the long term projections.

ACKNOWLEDGEMENTS

The Chair thanks the reviewer, Doug Swain, for his extensive review, as well as all participants for their involvement, and Kate Rutherford for being an excellent rapporteur. The assistance of Nic Dedeluk in providing support for meeting logistics is greatly appreciated.

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APPENDIX A: AGENDA

Regional Peer Review Meeting

Centre for Science Advice Pacific

AGENDA

Review of Updated stock assessment for Bocaccio (*Sebastes paucispinis*) in British Columbia waters for 2012.

Tuesday 29th May 2012
Pacific Biological Station, Nanaimo, British Columbia

Chairperson: Andrew Edwards

Review of working paper:
Updated stock assessment for Bocaccio (*Sebastes paucispinis*) in British Columbia waters for 2012, by Richard D. Stanley, Murdoch McAllister, and Paul J. Starr. CSAP Working Paper 2012/P42.

Time	Agenda Item	Presenter
9:00	Introductions	Chair & participants
	Review agenda & housekeeping	Chair
	CSAS overview & procedures	Chair
	Review Terms of Reference	Chair & participants
9:30	Presentation of working paper	Authors
10:15	First review & authors' responses	Doug Swain, Gulf Fisheries Centre, DFO, Moncton (via Webinar).
10:45	**Break**	
11:00	Continuation of first review	Doug Swain
11:15	Second review & authors' responses	Michael Folkes, Salmon Stock Assessment, PBS, DFO.
12:00	**Lunch break**	
12:45	Confirmation of key issues for discussion.	Participants
1:00	Discussion of key issues. 1. Are the data and methods adequate to support the conclusions? 2. Does the advice reflect the uncertainty in the data, analysis or process? 3. Does the paper meet the objectives in the Terms of Reference?	Participants
1:45	Decision on acceptability of working paper.	Participants

Time	Agenda Item	Presenter
	Consensus regarding: • Key Findings & Conclusions • Uncertainties • Ecosystem Considerations • Advice for Management Recommendations for Future Work	
2:30	***Break***	
2:45	Summary of conclusions and advice for Science Advisory Report	Participants
4:30	**Adjourn**	

APPENDIX B: ATTENDEES

Last Name	First Name	Affiliation
DFO		
Davis	Neil	Fisheries Aquaculture Management
Edwards	Andrew	Science, Groundfish Section
Flemming	Rob	Science, Groundfish Section
Francis	Kelly	SARA
Holt	Kendra	Science, Groundfish Section
MacConnachie	Sean	Science, Conservation Biology (SARA)
Rutherford	Kate	Science, Groundfish Section
Stanley	Rick	Science, Groundfish Section
Tadey	Rob	FAM GROUNDFISH Management
Magnusson	Gisele	Policy
Sidhu	Jas	SARA
Swain	Doug	Gulf Region
External		
Argue	Sandy	Province of BC
Edwards	Dan	UFAWU (United Fishers & Allied Workers Union)
Harling	Wayne	Sport Fishing Advisory Board (SFAB)
McAllister	Murdoch	University of British Columbia
Mose	Brian	Commercial Industry Caucus - Trawl
Sinclair	Alan	COSEWIC
Starr	Paul	Canadian Groundfish Research and Conservation Society
Turris	Bruce	Canadian Groundfish Research and Conservation Society
Valentin	Alexandra	COSEWIC

APPENDIX C: TERMS OF REFERENCE

Terms of Reference

Updated assessment of Bocaccio Rockfish in British Columbia

Regional Peer Review - Pacific Region

Tuesday 29th May 2012
Nanaimo, British Columbia

Chairperson: Andrew Edwards

Context

On January 15, 2004, the Minister of the Environment received a document on Bocaccio from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) which assessed the Bocaccio population in British Columbia waters as Threatened. This prompted the Department of Fisheries and Oceans Canada (DFO) to conduct extended consultations with the government of British Columbia, Aboriginal peoples, stakeholders, and the public on whether or not the Bocaccio population should be added to the List of Wildlife Species at Risk (Schedule 1) under the Species at Risk Act. Results of these consultations led the Governor in Council, through the Minister of the Environment, on April 6, 2006 to refer the assessment back to COSEWIC for further information and consideration. (See the Species at Risk Public Registry page given below for further details of decisions).

In December 2006, COSEWIC reaffirmed the original assessment without reassessing the species, citing an absence of new information that would lead to a change in the status of this species. In 2010, the Governement of Canada, on the recommendation of the Minister of the Environment, acknowledged receipt of the Bocaccio assessment conducted under subsection 23(1) of the *Species at Risk Act* by COSEWIC.

Following extensive review, the Governor in Council in 2011 decided not to add Bocaccio to the List of Wildlife Species at Risk. This decision was based on the recommendation of the Minister of the Environment on the advice of the Minister of Fisheries and Oceans, taking into account the assessments provided by COSEWIC.

Although it was recognized that the stock was likely in the "critical zone" under the DFO Precautionary Approach (DFO 2009, Stanley et al. 2009), the decision was made after weighing the costs of listing against the anticipated benefits. It was determined that the costs of protection under SARA would likely outweigh the benefits to Canadians.

However, the statement noted that protective measures would be taken under existing legislative tools such as the *Fisheries Act*, as well as non-legislative tools such as government programs and actions by non-governmental organizations, which may provide protection to Bocaccio.

Among the steps taken to provide protection to the Bocaccio population, an updated DFO assessment of Bocaccio was scheduled for review in 2011 or 2012, that would not only update previous work with four more years of data, but coincide with a COSEWIC re-assessment scheduled for 2012.

Objectives

The objective of this Regional Peer Review Meeting is to review the following working paper:

> Richard D. Stanley, Murdoch McAllister, and Paul J. Starr. Updated stock assessment for Bocaccio (*Sebastes paucispinis*) in British Columbia waters for 2012. *CSAP Working Paper 2012/P42*.

The objectives of the working paper are to:

- update the previous assessment with four more years of data;
- provide, with rationale, a Limit Reference Point, an Upper Stock Reference, a Target Reference Point and a Removal Reference, guided by the DFO Sustainable Fisheries Framework (DFO 2009);
- assess the status of the stock relative to the recommended reference points;
- predict the consequences of varying harvest levels on future population trends.

The resulting information and advice may be used to assist development of groundfish management plans.

Expected publications

- CSAS Science Advisory Report (1)
- CSAS Research Document (1)
- CSAS Proceedings (1)

Participation

- DFO Science Branch, Fisheries Management Branch and Ecosystems Management Branch
- Province of BC
- Commercial and recreational fishing interests
- First Nations
- Non-government organizations
- Academia
- External reviewers
- Other stakeholders

References

Species at Risk Public Registry page for Bocaccio (including links to aforementioned recommendations and decisions)

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APPENDIX D: ABSTRACT OF THE WORKING PAPER

ABSTRACT

This document provides a stock assessment for Bocaccio in BC waters using data current to 2011. Results of the work are intended to serve as advice over the short term to managers and stakeholders on current stock status, and likely impacts of different harvest options. As in previous work, a Bayesian surplus production model was used. It was fit to one fishery dependent and eight fishery independent biomass indices, and a reconstructed catch history back to 1935 when the population was assumed to be near to an unfished equilibrium. Catch histories for some sectors were imputed from limited data. For the first time in a Bocaccio assessment, recreational catch was included as in input to the model. As in the previous work, this analysis indicates that Bocaccio exploitable stock biomass has declined significantly from the 1930s, with the steepest decline occurring from 1985 to 1995. The rate of decline slowed after 1995. While there is considerable uncertainty in estimating recent trends there is no sign that the population has started to increase, and is more than likely continued to decline over the most recent decade. Based on the reference case results, the median estimate of stock size relative to its unfished stock size (B_{2012}/K) is 3.5%. The median estimate of current abundance relative to B_{msy} is 7% with 90% confidence limits of 2.9% and 18.2% leaving little or no likelihood that the stock is currently above the lower PA reference point of $0.4*B_{msy}$, based on the reference case. Current harvests are approximately equal to the estimate of replacement yield. The impacts of alternative model assumptions from those used in the reference case were explored in eight additional sensitivity runs. Long term biomass projections were made for the reference case and a selection of the sensitivity runs over 5, 20, and 60 year scenarios under varying fixed harvest assumptions from 0-200 t/y. Results of the forecasts were presented relative to the DFO draft policy target references points of $0.4*B_{msy}$ and $0.8*B_{msy}$. While the Bayesian approach used in this assessment provides a formal mechanism to include uncertainty in model output (including predictions), managers, and stakeholders are advised that not all sources of uncertainty have been addressed and that it is likely that the true uncertainty is even greater than that presented here.

APPENDIX E: WRITTEN REVIEW

Review of WP 2012/P42: Stanley et al. Updated stock assessment for bocaccio.

Doug Swain,
DFO, Gulf Fisheries Centre, Moncton, NB

General comments

I will begin this review with a caveat. A tremendous amount of work, documented in this working paper and in earlier documents (Stanley et al. 2009, McAllister et al. 2010), underpins this assessment. In the couple of days available to me to conduct this review, I have not been able to examine this material as thoroughly as might be wished. However, the foundations for this assessment have already been thoroughly reviewed in the previous assessment meeting (DFO 2008) and in the peer-reviewed literature.

The assessment team has faced a very difficult problem in this assessment. The biomass indices available for this stock are mostly restricted to the most recent decade or less. Most of the indices, including the only two longer term indices, cover only relatively small portions of the stock area. Both catch and survey data are age-aggregated, and no catch records are available for some fisheries that were responsible for an important portion of the catch, particularly in earlier years. Given these data limitations, I think that the Bayesian surplus production modelling approach used for this assessment is the most appropriate method available. In addition to being a good approach for handling uncertainty, this approach facilitates incorporating expert opinion and other prior information into the modelling, which is particularly important in very data-limited situations like this assessment. In this regard, the development of an informative prior for r based on life-history information is an important feature of this assessment.

Another factor critical to the success of this assessment was the re-construction of the annual catch back to a time when it is reasonable to assume that the stock was only slightly depleted by fishing. This was a difficult task due to many data gaps, and the authors' approach to filling these gaps was rigorous and innovative. While uncertainties and possible biases that cannot be taken into account in the modelling may persist (see below), I don't think that this affects the conclusion that this stock is severely depleted and is in the critical zone with a very high probability.

The development of informative priors for survey catchability (q) is another innovative component of this assessment. While I find it surprising that priors for q_{net} can be developed based on expert opinion, particularly for a non-target species, the resulting estimates seem sensible (based on the sum of the q's for the 4 groundfish trawl surveys).

In conclusion, although the data are limited, I think that the main conclusions of this assessment are well supported by the analyses conducted by the authors. I list some questions, comments and suggestions below, but these do not affect the main conclusions of this assessment. Uncertainty is well reflected in the advice presented by the authors but, as noted by the authors, not all sources of uncertainty could be taken into account. These sources of uncertainty should be described in the Science Advisory Report. I commend the authors on their comprehensive and innovative analysis.

Specific Comments

1. *Sources of uncertainty*: The Bayesian approach used by the authors is a good method for taking uncertainty into account and incorporating it in advice. However, as noted by the authors, not all sources of uncertainty could be addressed and true

uncertainty is likely to be greater than presented here. In my view, the Science Advisory Report should include a section on sources of uncertainty to describe some of the uncertainties not accounted for in the advice. Some candidates for this section are discussed below.

2. *Availability to surveys*: Both of the longer term surveys for this stock, the US triennial survey (1980-2001) and the WCVI shrimp survey (1975-present), only cover a small portion of the stock area. Thus, their use as indices of biomass requires the assumption that no changes in availability of bocaccio (i.e., the proportion of the stock distributed within the survey areas) have occurred over time. Is there any information to support this assumption?

   This problem is less severe for the recent period because the IPHC survey (2003-2011) (and perhaps the commercial cpue index?) covers most of the stock area. In addition, four groundfish surveys, which combined together cover most of the stock area, were initiated in the 2003-2006 period. Although not all these surveys were conducted in any particular year, these surveys should identify any shifts in distribution that could affect availability to particular surveys.

   In my view, the conclusion that this stock is currently severely depleted is not in doubt due to potential changes in availability to surveys. The main information provided by these surveys is that there have been no increases in biomass following the sharp decline in catch in the mid 1990s. Even though most surveys cover only a portion of the stock area, given the large number of indices available since the early 2000s I think that it is clear that boccacio has not been increasing during this period.

3. *Catch estimation*: An important feature of this assessment is the re-construction of the catch history back to 1935. The approach taken by the authors was comprehesive. The bycatch in the halibut and salmon troll fisheries was problematic because only records of effort were available yet these fisheries were likely to be important sources of bocaccio catch, particularly in earlier periods. To address this issue the authors estimated catchability (k) to these fisheries based on estimates of bycatch in these fisheries in particular periods. For the halibut fishery, bocaccio bycatch was available for 2006-2011. For the salmon troll fishery, catch was estimated for 1976-1985 based on the recollections of fishermen. This is a reasonable way forward, but includes uncertainties not accounted for in the modelling. For example, this requires the assumption that k has been constant over time. This is unlikely, at least for target species, though it may be less problematic for non-target species like bocaccio.

   There has been a dramatic change in the catch estimates for the halibut fishery between the last assessment and this assessment. For example, annual bycatch in this fishery in the 1935-1940 was estimated to be about 375 t in the earlier assessment and about 1200 t in this assessment. This doesn't appear to be noted in the working paper (though I may have missed it), but should be. It presumably reflects the used of additional catch data to estimate k in this assessment. This indicates that uncertainty in k is not fully accounted for in the modelling.

4. *Prior on P_0*: The data contain no information on P_0. In order to support a reasonably informative prior for P_0, the authors have initiated the population model in 1935, when bocaccio is thought to have been only lightly fished. Data on catches or effort in most fisheries taking bocaccio support this conclusion. However, effort in the halibut fishery in the mid to late 1930s was at the highest levels observed in the model period (Fig. 7). What is known about effort in the halibut fishery prior to 1935? Did effort quickly increase from very low levels to peak levels in the late 1930s? Or

was there a period of intense fishing prior to 1935? What are the implications for the prior on P_0 given the high catches associated with the high effort in the late 1930s?

5. *Observation error*: Instead of including the standard deviation of observation error for each survey as a parameter in the model, fixed values for these SD's were obtained by "iterative re-weighting" (p. 91 in the 2009 res doc). I don't understand what was done here, but my guess is that it involves using the standard deviation between observed survey indices and the values predicted by the model. If so, I think that there is a problem with this approach. Failure for the model to fit a survey time series with a clear trend will be interpreted as a problem with the survey (a noisy index) rather than a problem with the model (i.e., failure for the model to account for some important feature like a change in productivity). This would be especially problematic when the SD for process error is fixed at a low value (as in the models used here). I think that there may be an issue in this regard with respect to the US triennial survey. This survey indicates a sharp decline in bocaccio biomass in the 1980s, which the model does not fit. This failure to fit the decline appears to be attributed to a nosiy index. Table 71 in the 2009 res doc lists SD's for the various surveys. Both the US triennial survey and the WCVI shrimp trawl survey have very high SD's (1.35). I agree that the WCVI shrimp trawl survey is a very noisy survey for bocaccio, but the US triennial survey does not appear to be.

   An alternative approach would be to include the observation error SD's as parameters in the model. Informative priors could be used for each index, with a lower limit based on the average CV for the index and an upper limit set at 2-4 times the lower limit.

6. *Failure to fit the decline indicated by the US triennial survey*: As noted above, the model doesn't fit the decline indicated by this survey. I suspect that failure to fit this decline has little impact on the likelihood of the model due to the large number of short-term recent indices included in the model, as well as the much greater amount of data associated with the very noisy WCVI shrimp trawl survey. The clear signal in the triennial survey may be indicative of some process not explicitly incorporated in the model (e.g., a decline in productivity), or it could reflect a biased index due to a decline in availability to this survey. To explore the first possibility, I suggest a sensitivity run incorporating only the triennial survey and a recent survey (the WCVI groundfish trwl survey). I suggest one run with the SD of process error set at the reference value of 0.1 and a second run set at about 0.3.

7. *Projection test*: With annual catch less than 150 t, projections in the 2009 assessment indicated increasing trends in biomass. Recent catches have been less than 140 t, but the current model indicates a declining trend over the 2008-2012 period. This may reflect changes in the model and catch history since the last assessment, ot it may indicate that projections are too optimistic (e.g., because some feature of population dynamics such as a change in productivity is not accounted for in the model). This could be examined by fitting the model to the biomass indices up to 2005 and then projecting forward using the observed catches for 2006-2011.

8. *Changes in productivity?*: The population model assumes that productivity has been stationary over the 1935-2012 period. Changes in productivity can be accounted for to some extent through process error, though process error residuals have been constrained to have a relatively low SD. In Atlantic Canada, major declines in groundfish productivity over the past 20-25 years appear to be the rule rather than the exception. Are there any indications that there may have been important changes in productivty of bocaccio that are not captured by the population models?

9. *Normal likelihood function for the biomass index data*: Error distributions for trawl survey catch rate data are generally considered to be more closely approximated by a lognormal distribution than by a normal distribution. So the use of a normal likelihood function for the survey data seems like an extreme step to take in order to accommodate the occasional zero observation. Though a bit ad hoc, replacing rare zero observations by a small number (e.g., one-half or one-fifth of the lowest observed value) might be preferable. Other than the ability to include zeros, what were the consequences of the change from a lognormal to a normal likelihood function?

Minor comments:

a) Table 4: I find this table a bit confusing. Total rockfish includes all 3 regions, total boccacio and total effort include just south and central coasts. Also, the recent increase in boccacio catch in this table is not associated with an increase in effort. Does this reflect improved monitoring of catch to the species level?

b) There are many more males than females in age-length samples at ages over 30 yr. Does this reflect higher fishing mortality for females (due to greater size?), or higher natural mortality for females?

c) The proportion mature at age was estimated by applying a cumulative, renormalized lognormal density function. What is the advantage of this method over the standard logistic regression approach (which is probably more readily understandable to most readers, like myself)?

d) WCVI shrimp trawl survey - no tows in area 125 in 1989 and 1991. Catch rates in area 124 were applied to area 125 in these years. If catch rates tend to differ between these areas, a better approach might be to fit a model with year and area terms and use the predicted values for area 125 in these years. However, given the level of noise in this index, the added sophistication may not be warranted.

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